CLAIMS

What is claimed is:

1. A method of reverse link rate control at a wireless communication network base station comprising:

receiving a rate indication from each of one or more mobile stations being supported by the base station, wherein the rate indication from the mobile station indicates whether the mobile station desires to increase its reverse link data rate;

calculating a priority value for each of the one or more mobile stations that is proportional to a higher data rate if the rate indication indicates that a higher data rate is desired by the mobile station or otherwise is proportional to a current rate of the mobile station, and that is inversely proportional to a reverse link throughput of the mobile station;

ranking the one or more mobile stations based on their priority values; and

generating reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity.

2. The method of claim 1, further comprising performing the method of claim 1 in each of a succession of ongoing rate control intervals.

3. The method of claim 2, further comprising using the rate indications received in a current rate control interval to generate rate control decisions for a subsequent rate control interval.

4. The method of claim 1, wherein generating reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity comprises granting reverse link rate increases to the mobile stations as desired in rank order conditioned on the availability of sufficient reverse link capacity for each successive grant.

5. The method of claim 1, wherein calculating a priority value for each of the one or more mobile stations that is proportional to a higher data rate if the rate indication indicates that a higher data rate is desired by the mobile station or otherwise is proportional to a current rate of the mobile station, and that is inversely proportional to a reverse link throughput value of the mobile station further comprises including a fairness term in the calculation of each priority value.

6. The method of claim 1, further comprising maintaining the reverse link throughput values for the one or more mobile stations based on tracking the reverse link throughput of each mobile station.

7. The method of claim 6, wherein maintaining the reverse link throughput values for the one or more mobile stations based on tracking the reverse link throughput of each mobile station comprises maintaining filtered throughput estimates for the one or more mobile stations.

8. The method of claim 1, wherein generating reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity comprises:

assuming a down command as a default rate control command for all of the one or more mobile stations;

estimating a capacity value assuming that each mobile station will decrease its reverse link rate in a next rate control interval, or at least hold its rate at a minimum defined rate; and

selectively setting the rate control command for each mobile station taken in rank order to other than the down command by:

if the mobile station desires a rate increase, commanding a rate increase if the capacity value is sufficient to support that rate increase or, if not, commanding a rate hold if the capacity value is sufficient to support a current rate of the mobile station; and

adjusting the capacity value if either a rate increase or a rate hold was commanded for the mobile station.

9. The method of claim 1, wherein generating reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity comprises:

estimating a reverse link capacity value; and

evaluating the mobile stations in rank order and granting rate increases to each mobile station that desires a rate increase conditioned on whether the reverse link capacity value as adjusted to account for any rate increases granted to higher ranking mobile stations is sufficient to support the contemplated rate increase.

10. The method of claim 9, further comprising, for a given mobile station being evaluated in rank order, granting a rate hold as an alternative to granting a rate increase if the reverse link capacity value is not sufficient to support the contemplated rate increase.

11. A base station for use in a wireless communication network comprising:

transceiver circuits to send signals to a plurality of mobile stations on a forward link and to receive signals from the mobile stations on a reverse link;

processing logic to control the transceiver circuits, said processing logic including a rate control circuit configured to generate reverse link rate control decisions for the mobile stations by:

receiving a rate indication from each of one or more mobile stations being supported by the base station, wherein the rate indication from mobile station indicates whether the mobile station desires to increase its reverse link data rate;

calculating a priority value for each of the one or more mobile stations that is proportional to a higher data rate if the rate indication indicates that a higher data rate is desired by the mobile station or otherwise is proportional to a current rate of the mobile station, and that is inversely proportional to a reverse link throughput of the mobile station;

ranking the one or more mobile stations based on their priority values; and

generating reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity.

12. The base station of claim 11, wherein the base station is configured to generate new rate control decision for the one or more mobile stations in each of a succession of ongoing rate control intervals.

13. The base station of claim 12, wherein the rate control circuit is configured to use the rate indications received in a current rate control interval to generate the rate control decisions for a subsequent rate control interval.

14. The base station of claim 11, wherein the rate control circuit is configured to generate reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity by granting reverse link rate increases to the mobile stations as desired in rank order conditioned on the availability of sufficient reverse link capacity for each successive grant.

15. The base station of claim 11, wherein the rate control circuit is configured to calculate the priority value for each of the one or more mobile stations further based on a fairness factor.

16. The base station of claim 11, wherein the rate control circuit is configured to maintain the reverse link throughput values for the one or more mobile stations by tracking the reverse link throughput of each mobile station.

17. The base station of claim 16, wherein the rate control circuit is configured to track the reverse link throughput of each mobile station by maintaining filtered throughput estimates for the one or more mobile stations.

18. The base station of claim 11, wherein the rate control circuit generates reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity by:

assuming a down command as a default rate control command for all of the one or more mobile stations;

estimating a capacity value assuming that each mobile station will decrease its reverse link rate in a next rate control interval, or at least hold its rate at a minimum defined rate; and

selectively setting the rate control command for each mobile station taken in rank order to other than the down command by:

if the mobile station desires a rate increase, commanding a rate increase if the capacity value is sufficient to support that rate increase or, if not, commanding a rate hold if the capacity value is sufficient to support a current rate of the mobile station; and

adjusting the capacity value if either a rate increase or a rate hold was commanded for the mobile station.

19. The base station of claim 11, wherein the rate control circuit generates reverse link rate control decisions for the mobile stations based on their ranking and available reverse link capacity by:

estimating a reverse link capacity value; and

evaluating the mobile stations in rank order and granting rate increases to each mobile station that desires a rate increase conditioned on whether the reverse link capacity value as adjusted to account for any rate increases

granted to higher ranking mobile stations is sufficient to support the contemplated rate increase.

20. The base station of claim 19, wherein, for a given mobile station being evaluated in rank order, the rate control circuit is configured to grant a rate hold as an alternative to granting a rate increase if the reverse link capacity value is not sufficient to support the contemplated rate increase.

21. A method of reverse link rate control at a wireless communication network base station comprising:

determining a desired reverse link rate for each mobile station in a plurality of mobile stations supported by the base station based on a reverse link path loss and a maximum transmit power of the mobile station, or based on a rate indication from the mobile station;

calculating a priority value for each mobile station based on the desired rate and an average throughput of the mobile station; and

generating reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values.

22. The method of claim 21, wherein determining a desired reverse link rate for each mobile station in a plurality of mobile stations supported by the base station based on a rate indication from the mobile station comprises periodically receiving a rate indicator that selectively indicates whether the mobile station wishes to increase its reverse link data rate and setting the desired rate to a next higher defined data rate if the rate indicator indicates that a higher rate is desired unless a current rate of the mobile station is at a maximum.

23. The method of claim 22, wherein calculating a priority value for each mobile station based on the desired rate and an average throughput of the mobile station comprises calculating the priority value such that it varies in proportion to the desired rate and varies in inverse proportion to the average throughput.

24. The method of claim 23, wherein periodically receiving a rate indicator that selectively indicates whether the mobile station wishes to increase its reverse link data rate comprises receiving a new rate indicator per reverse link transmit frame, and wherein calculating a priority value for each mobile station based on the desired rate and an average throughput of the mobile station comprises calculating a new priority value per reverse link transmit frame.

25. The method of claim 21, wherein determining a desired reverse link rate for each mobile station in a plurality of mobile stations supported by the base station based on a reverse link path loss and a maximum transmit power of the mobile station comprises setting the desired reverse link rate to an achievable reverse link rate calculated from the maximum transmit power and the reverse link path loss.

26. The method of claim 21, wherein determining a desired reverse link rate for each mobile station in a plurality of mobile stations supported by the base station based on a reverse link path loss and a maximum transmit power of the mobile station comprises setting the desired reverse link rate to an achievable rate calculated according to Shannon's Capacity Theorem from the maximum transmit power, the reverse link path loss, and a base station estimate of total noise plus interference.

27. The method of claim 21, wherein determining a desired reverse link rate for each mobile station in a plurality of mobile stations supported by the base station based on a reverse link path loss and a maximum transmit power of the mobile station, or based on a rate indication from the mobile station comprises determining the desired reverse link

rate as an achievable rate for the mobile station based on the reverse link path loss and the maximum transmit power.

28. The method of claim 27, wherein determining the desired reverse link rate as an achievable rate for the mobile station based on the reverse link path loss and the maximum transmit power comprises calculating a SINR for the mobile station based on an estimate of noise and interference at the base station, the reverse link path loss, and the maximum transmit power, and calculating the achievable rate based on Shannon's Capacity Theorem.

29. The method of claim 27, wherein calculating a priority value for each mobile station based on the desired rate and an average throughput of the mobile station comprises determining the priority value as a ratio of achievable rate to average throughput.

30. The method of claim 29, wherein generating reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values comprises ranking mobile stations according to their priority values and making reverse link rate assignments for a next scheduling interval in rank order.

31. A method of reverse link rate control at a wireless communication network base station comprising:

determining an achievable data rate for each of a plurality of mobile stations based on a reverse link path loss of the mobile station and a maximum transmit power of the mobile station;

calculating a priority value for each mobile station based on the achievable rate determined for the mobile station; and

generating reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values.

32. The method of claim 31, further comprising receiving maximum transmit power information from one or more of the mobile stations.

33. The method of claim 32, further comprising using a default maximum power value as the maximum transmit power of one or more of the mobile stations.

34. The method of claim 31, wherein determining an achievable data rate for each of a plurality of mobile stations based on a reverse link path loss of the mobile station and a maximum transmit power of the mobile station comprises calculating the achievable rate according to Shannon's Capacity Theorem based on a SINR that could be achieved by the mobile station given its maximum transmit power and its reverse link path loss.

35. The method of claim 34, further comprising maintaining an estimate of total interference plus noise at the base station to be used in determining the SINR for the mobile station.

36. The method of claim 31, wherein calculating a priority value for each mobile station based on the achievable rate determined for the mobile station comprises calculating the priority value as a ratio of the achievable rate to an average reverse link throughput of the mobile station.

37. The method of claim 36, further comprising calculating the priority value further based on one of a fairness service objective or a maximum throughput service objective.

38. The method of claim 31, further comprising determining the reverse link path loss for each mobile station based on an indication of received forward link power at the mobile station and knowledge of corresponding transmitted forward link power at the base station.

39. The method of claim 38, wherein determining the reverse link path loss for each mobile station based on an indication of received forward link power at the mobile station and knowledge of corresponding transmitted forward link power at the base station comprises:

receiving reports of received forward link power from the mobile station; and

tracking forward link transmit power used to transmit to the mobile station.

40. The method of claim 39, wherein receiving reports of received forward link power from the mobile station comprises periodically receiving a report of average forward link traffic channel at the mobile station, and wherein tracking forward link transmit power used to transmit to the mobile station comprises maintaining an average of forward link traffic channel transmit power at the base station.

41. The method of claim 31, wherein generating reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values comprises ranking the mobile stations according to their achievable rates, and selecting one or more of the mobile stations in rank order for scheduled use of the reverse link in a next scheduling interval.

42. The method of claim 41, further comprising limiting the number of mobile stations selected based on a reverse link target loading.

43. The method of claim 31, wherein generating reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values comprises ranking the mobile stations according to their achievable rates, selecting one or more of the mobile stations in rank order, and granting reverse link rate increases to the selected mobile stations.

44. A base station for use in a wireless communication network comprising:

transceiver circuits to send signals to a plurality of mobile stations on a forward link and to receive signals from the mobile stations on a reverse link;

processing logic to control the transceiver circuits, said processing logic including a rate control circuit configured to generate reverse link rate control decisions for the mobile stations by:

determining an achievable data rate for each of a plurality of mobile stations based on a reverse link path loss of the mobile station and a maximum transmit power of the mobile station;

calculating a priority value for each mobile station based on the achievable rate determined for the mobile station; and

generating reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values.

45. The base station of claim 44, wherein the rate control circuit is configured to determine an achievable data rate for each of a plurality of mobile stations based on a reverse link path loss of the mobile station and a maximum transmit power of the mobile station by calculating the achievable rate according to Shannon's Capacity Theorem based on a SINR that could be achieved by the mobile station given its maximum transmit power and its reverse link path loss.

46. The base station of claim 45, wherein the rate control circuit is configured to maintain an estimate of total interference plus noise at the base station to be used in determining the SINR for the mobile station.

47. The base station of claim 44, wherein the rate control circuit is configured to calculate a priority value for each mobile station based on the achievable rate determined for the mobile station by calculating the priority value as a ratio of the achievable rate to an average reverse link throughput of the mobile station.

48. The base station of claim 47, wherein the rate control circuit is configured to calculate the priority value further based on one of a fairness service objective or a maximum throughput service objective.

49. The base station of claim 44, wherein the rate control circuit is configured to determine the reverse link path loss for each mobile station based on an indication of received forward link power at the mobile station and knowledge of corresponding transmitted forward link power at the base station.

50. The base station of claim 49, wherein the rate control circuit is configured to determine the reverse link path loss for each mobile station based on an indication of received forward link power at the mobile station and knowledge of corresponding transmitted forward link power at the base station by:

receiving reports of received forward link power from the mobile station; and

tracking forward link transmit power used to transmit to the mobile station.

51. The base station of claim 50, wherein the rate control circuit is configured to periodically receive a report of average forward link traffic channel at the mobile station, and track forward link transmit power used to transmit to the mobile station by maintaining an average of forward link traffic channel transmit power at the base station.

52. The base station of claim 44, wherein the rate control circuit is configured to generate reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values by ranking the mobile stations according to their achievable rates, and selecting one or more of the mobile stations in rank order for scheduled use of the reverse link in a next scheduling interval.

53. The base station of claim 52, wherein the rate control circuit is configured to limit the number of mobile stations selected based on a reverse link target loading.

54. The base station of claim 44, wherein the rate control circuit is configured to generate reverse link data rate control decisions for one or more of the plurality of mobile stations based on their corresponding priority values by ranking the mobile stations according to their achievable rates, selecting one or more of the mobile stations in rank order, and granting reverse link rate increases to the selected mobile stations.

55. A mobile station comprising:

a transceiver circuit to send signals to and receive signals from a wireless communication network base station; and

one or more processing circuits to process the signals sent and received via the transceiver circuit, said one or more processing circuits comprising a rate control support circuit configured to track received forward link signal power and to generate corresponding power reports for transmission to the base station.

56. The mobile station of claim 55, wherein the rate control circuit is configured to transmit a power report on a per frame basis, wherein the mobile station transmits a power report per reverse link transmit frame.

57. The mobile station of claim 55, wherein the rate control circuit is configured to track received forward link signal power based on maintaining a filtered estimate of received traffic channel power.